US 20020066629A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2002/0066629 A1**

Muller (43) **Pub. Date: Jun. 6, 2002**

(54) **PROCESS FOR BRAKING A MOVING MASS SUCH AS A BRAKING AND DAMPING ELEMENT**

(76) Inventor: **Wolfgang Muller**, Lustenau (AT)

Correspondence Address:
John M. Harrington
KILPATRICK STOCKTON, LLP
1001 West Fourth Street
Winston-Salem, NC 27101 (US)

(21) Appl. No.: **09/729,659**

(22) Filed: **Dec. 4, 2000**

Publication Classification

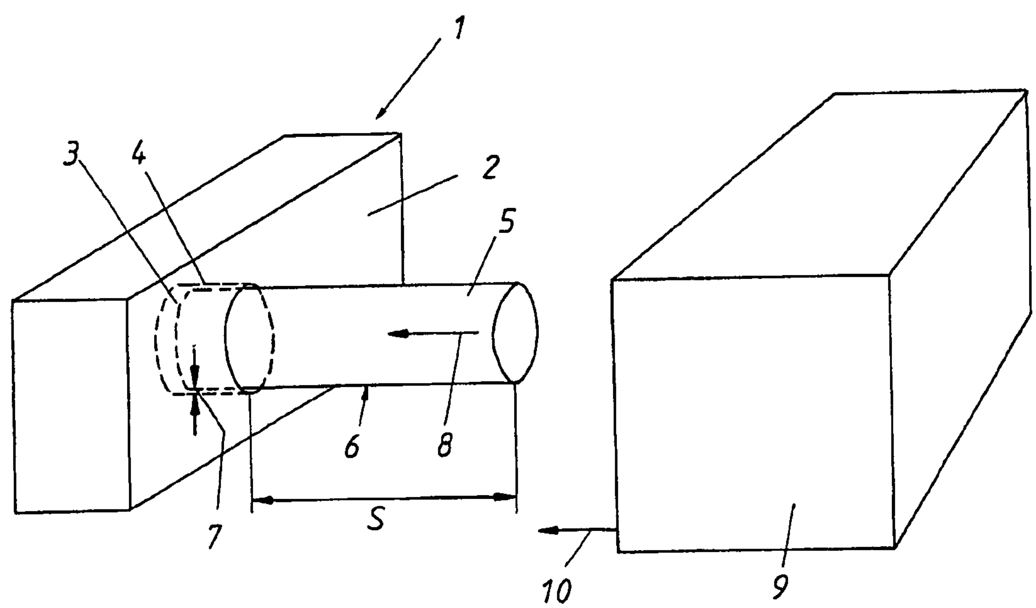
(51) **Int. Cl.[7]** **F16F 7/10**

(52) **U.S. Cl.** **188/380**

(57) **ABSTRACT**

The invention concerns a process for braking or decelerating a moving mass, as well as a suitable braking and damping element.

The invention distinguishes itself in that one or more surfaces are moistened with a highly viscous liquid-containing medium, that the braking and damping element always has a fixed part and a movable part, that after the mass impacts with the movable part, are moved against each other for a certain distance, so that the liquid-containing medium by its retention on the surfaces, puts out an inner molecular friction; whereby, the kinetic energy of the mass to be intercepted, is transferred in frictional heat.



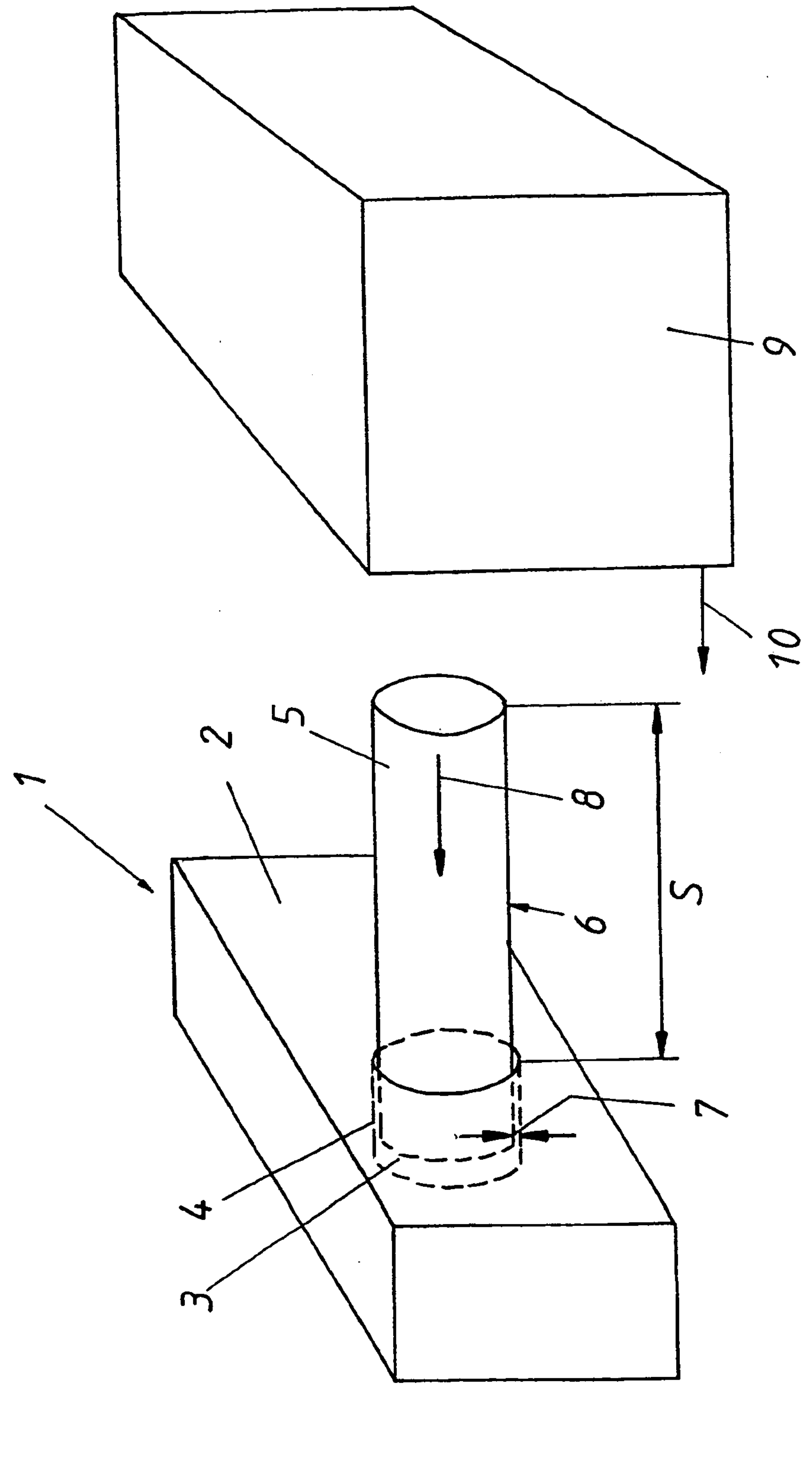


FIG. 1

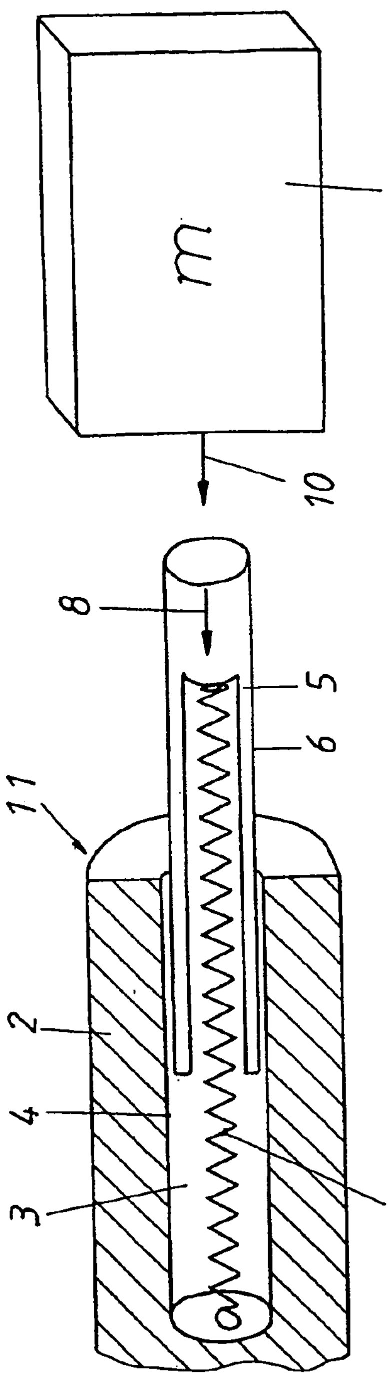


FIG. 2

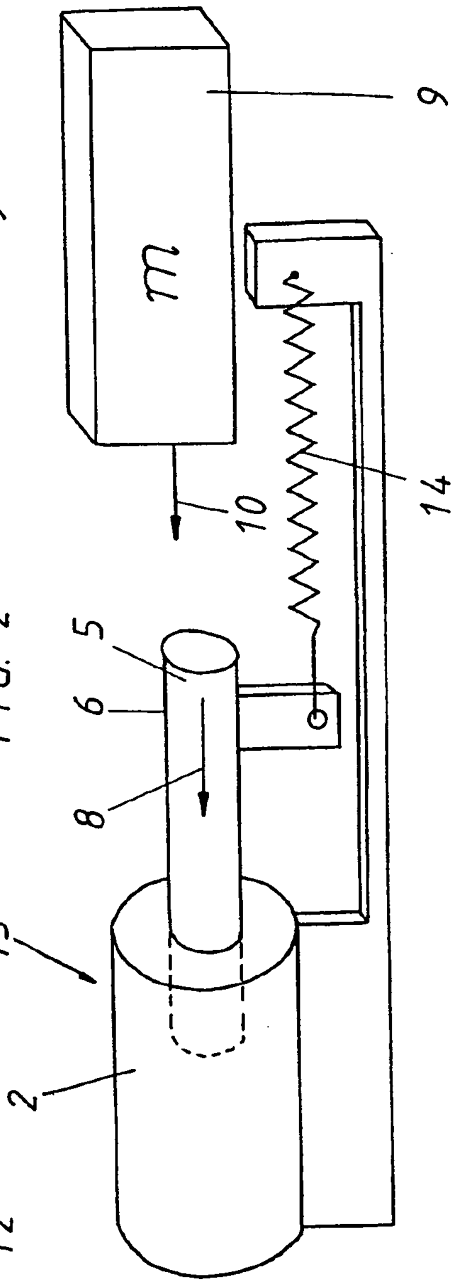


FIG. 3

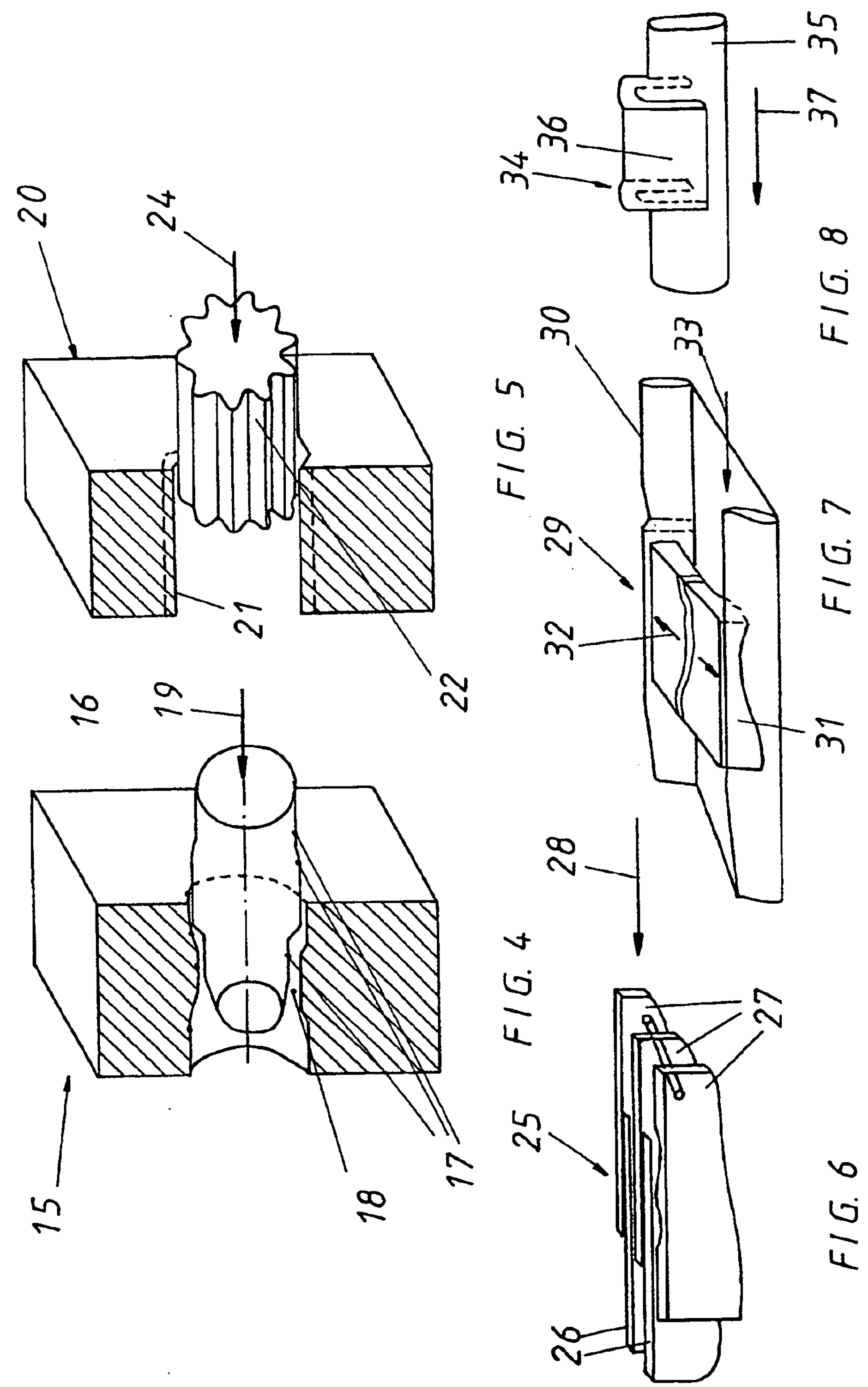


FIG. 4

FIG. 5

FIG. 6

FIG. 7

FIG. 8

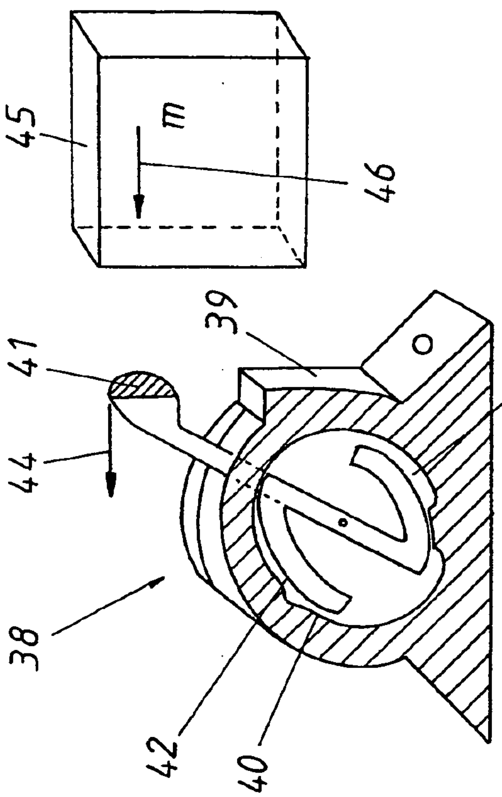


FIG. 9

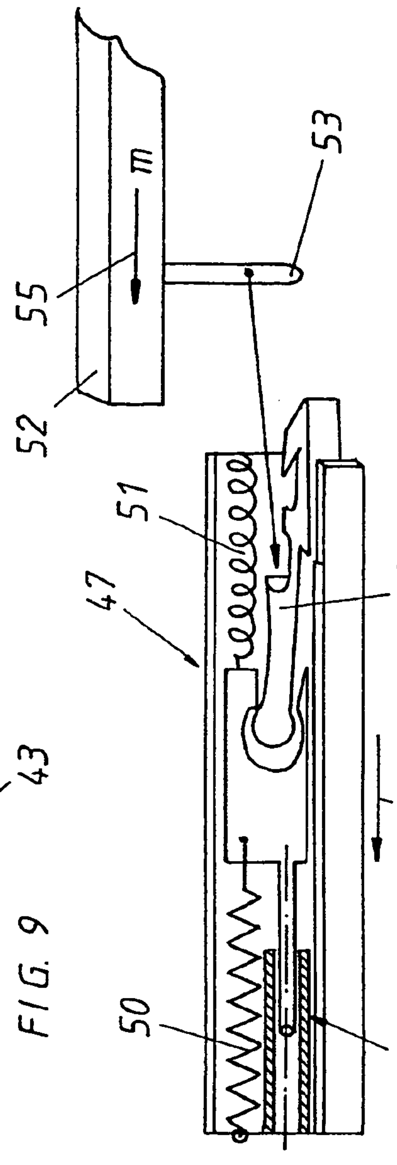


FIG. 10

PROCESS FOR BRAKING A MOVING MASS SUCH AS A BRAKING AND DAMPING ELEMENT

[0001] The invention concerns a procedure for braking or decelerating a moving mass, as well as a suitable braking and damping element, according to the introductory characterizing clause of the individual independent patent claims.

[0002] Braking and damping elements are known in diverse embodiments in the technology and are used in different applications and fields.

[0003] So, among other things, hydraulic shock absorbers are known that have a piston-cylinder system with two working chambers between which a liquid medium flows that activates the braking effect. Dampers of this type have a high level of static friction, caused by piston rods and piston seals, this results in a significant reduction of structural sizes available. Furthermore, they are very costly and expensive to produce and are, therefore, used only for those special applications, where expenses play a subordinate role.

[0004] With furniture/cabinets, especially drawers and furniture/cabinet doors, friction-based braking and damping elements are usually used in connection with spring elements. Such braking elements are made known in DE 199 15 164 A1 or DE 197 17 937 A1.

[0005] These friction braking elements can lead, by their static friction, to the so-called Stip-Stick-Effect, which becomes apparent when the parts to be braked or decelerated rattle, vibrate, get stuck, etc. Likewise, abrasion plays a big role with friction dampers, especially when masses with high kinetic energy must be braked or decelerated.

[0006] The task of the invention is a procedure to brake a moving mass and to propose a suitable braking and damping element that is simple and inexpensive, and that allows the braking of a moving mass over a certain distance with adjustable braking characteristics and nearly abrasion-free braking and deceleration.

[0007] The solution of this task takes place, according to the invention, via the features and characteristics described in the individual and independent patent claims.

[0008] The core of the invention is based on the facts that one or several surfaces are moistened with a highly viscous liquid containing medium; that, it always has a fixed and a mobile part of the braking and damping element, and these are moved against each other after the mass impacts on the movable part for a certain distance, so that the liquid-containing medium is set out to an inner molecular friction by its adhesion at the surfaces; whereby, the kinetic energy of the mass, which can be intercepted, is transferred in the frictional heat.

[0009] With the invention a higher speed can be used; it can be moved manually or with a foreign energy, guided linearly or turning stored mass of the type, to be intercepted, so that the kinetic energy of the mass is converted by a pre-selectable way and because of a structural design of a pre-selectable damping feature, without recoil in the predominantly friction heat. If desired, the remaining way can be returned up to a pre-set end stop with a certain, by a pre-selectable design, brake action with very little static friction without the Stip-Slick-Effect, if so chosen, supported by spring tension.

[0010] Advantageous embodiments and further developments of the invention are given in the dependent patent claims.

[0011] According to the invention a medium is inserted between the parts, which are movable in relation to each other. The medium's friction rate (coefficient of friction) depends on the speed or rate of the parts moving against each other (that is, the speed of the mass to be decelerated or braked). This is achieved by the application of a highly viscous medium that has a viscosity of several tens of thousands to several millions Pa's.

[0012] Therefore, because the coefficient of friction is low in smaller speeds, only a slight force (for example, spring tension) must be applied after braking or decelerating the mass, in order to move the mass up to a pre-selected end stop.

[0013] In an advantageous manner, the damping process can be adjusted by changing the distance and/or adjusting or changing the surface form. By axial profiling (that is, profiling in the movement direction of the movable part) the running of the mass' gap is guided between the "friction surface," dependent upon the path of the mass, which results in a freely selectable damping curve (progressive, decreasing, tapering, linear, specific restraint). By radial profiling, for example, the surfaces of both parts that move against each other, are increased, which allows a smaller structural size. Axial profiling in combination with radial profiling leads to a smaller size with optimized damping features.

[0014] In a preferred embodiment, the invention has a recess or notch in any cross-section in one of the parts (for example, the fixed part of the braking and damping element), in which is held movable essentially the same cross-section properties of the other part (for example, the movable part), so that a gap is available between the surface of the notch and the surface of the movable part in which the medium is located. So the largest diameter of one of the parts is about double the gap width less than the smallest diameter of the notch into which it is guided.

[0015] Thus, the notch and/or the surface of the movable parts are profiled axially and/or radially, with which the structure size and/or damping characteristics can be influenced.

[0016] In another embodiment of the invention, the braking and damping element have several lamellas that move against each other. By inserting several thin, paired flat lamella elements that are connected to each other, there results an increase of effective surfaces with minimal structural shape. The flat elements can also be profiled in all dimensions to control the damping characteristics.

[0017] In another embodiment of the braking and damping element, the structure is formed as a shoe brake in the form of an inner or outer shoe brake. The effective surfaces can be pressed against a fixed surface, similar to a shoe brake, by at least two braking and damping elements through fixed gap dimensions or, especially, also by controlled gap size or gap compression. This design is suitable for the implementation as an inside or outside shoe brake.

[0018] As already mentioned, the lamella surfaces and/or shoe brakes and/or the respective opposing surfaces can be profiled.

[0019] Another embodiment provides, instead of a linearly moving braking and damping element, that the movable part is formed as a revolving rotation part in the fixed part. The movable part also executes a rotation movement, which is caused by the impact of the mass. Eventually, a reversing mechanism must be provided between the moving mass and the movable part.

[0020] After the completed braking and damping cycle, it can be provided that the braking and damping element can go back again to its normal (starting) position. This is, according to the invention, achieved with an activated pull-back member on the movable part.

[0021] In the advantageous manner, the pull-back member is designed as a spring element. It can be a separate tension or compression spring that engages on the active part and the braking and damping element can be reset with minimal force for the next braking and damping cycle. The pull-back force can be set very low, because with many application cases, there must be sufficient time available to pull back to the normal position for the next braking and damping cycle.

[0022] Additionally, in a further development of the invention, a pull-back free-running is provided that forces the lifting or release of the braking action. The pull-back free-running is achieved by forced guided load alleviation of the surface pressure or increasing the surface distance between both parts, for example. A braking and damping effect can be undesirable for technical application reasons concerning pulling back the mass to be braked, making a free-running necessary. This is achieved by directionally changing or adjusting the damping or absorbing action by the pair of surfaces in the gap's dimensions.

[0023] Furthermore, a buffer made of elastic and/or springy material is placed between the mass to be braked or decelerated and the movable part of the braking and damping element. The buffer is attached or located, as desired, on one of the touching parts, and serves to dampen the noise of impact when the mass to be braked or decelerated meets the braking or damping element. The impact of the mass on the active damping part causes a noise, also resulting from the low mass of the damping part and can be minimized by means of a rubber-type or springy-designed soft buffer part (for example, plastic part), integrated into the available part.

[0024] Naturally, the recommended braking and damping element can be combined with other braking and damping devices.

[0025] The invention-related braking and damping element has a wide range of applications (for example, in hinges, drawer slides, furniture hardware, etc.).

[0026] The invention is subsequently more closely described by several embodiments examples, at hand, with reference to the drawings. Further characteristics, features and advantages of the invention are given in the drawings and their descriptions.

[0027] Shown:

[0028] **FIG. 1**: a schematic perspective view of braking and damping elements in a first embodiment;

[0029] **FIG. 2**: a sectional representation of the braking and damping element in an embodiment with integrated pull-back member;

[0030] **FIG. 3**: a further embodiment of the braking and damping element with pull-back member;

[0031] **FIG. 4**: a sectional representation of an embodiment of the braking and damping elements with profiled surfaces;

[0032] **FIG. 5**: a sectional representation of an embodiment of the braking and damping elements with profiled surfaces;

[0033] **FIG. 6**: an embodiment of the braking and damping element with several, lamella-type parts that are able to move against each other;

[0034] **FIG. 7**: an embodiment of the braking and damping element with a shoe brake in one of the slides;

[0035] **FIG. 8**: an embodiment of the braking and damping element with an operating shoe brake in one of the running surfaces;

[0036] **FIG. 9**: an embodiment of the braking and damping element with a rotary-operated movable part;

[0037] **FIG. 10**: an embodiment of the braking and damping element, integrated in a catch device for drawer rails.

[0038] **FIG. 1** shows an embodiment of the braking and damping element (**1**), which essentially consists of a fixed part (**2**) and, opposite the fixed part (**2**), a movable part (**5**). The fixed part (**2**) has a notch (in this case, a bore hole [**3**]) into which the (for example, cylindrically designed) movable part (**5**) is guided. The diameter of the bore hole (**3**) is slightly larger than the outer diameter of the movable part (**5**) so that a gap (**7**) remains between the bore hole's (**3**) surface (**4**) and the movable part's (**5**) surface (**6**). The surfaces (respectively **4** or **6**) are moistened with a highly viscous medium, which basically fills up the gap (**7**). The highly viscous medium holds to the moistened surface (**4**, **6**) and resists the motion of the parts (**2**, **5**), that move to each other, depending on the viscosity of the medium, the gap's width (**7**) and the speed the parts (**2**, **5**) are moving towards each other. With this braking and damping element (**1**), a moved mass (**9**), which moves in arrow direction (**10**), should be braked or decelerated within a certain distance s. In the normal (starting) position of the braking and damping element (**1**), the movable part (**5**) is pointed in the direction of the mass (**9**) to be braked or decelerated and projects out around the distance s from the bore hole (**3**) of the fixed part (**2**). Then the mass (**9**) meets the movable part (**5**), so the highly viscous medium by its retention to both surfaces **4**, **6**) is released by an inner molecular friction, which transfers the kinetic energy of the mass (**9**) to be intercepted in friction heat and decelerates or brakes the mass (**9**) within the distance s. The movable part (**5**) then moves in the arrow direction (**8**) into the bore hole (**3**) of the fixed part (**2**) and, in fact, within this distance s.

[0039] **FIGS. 2 and 3** show, with regard to **FIG. 1**, a somewhat modified schematic embodiment of the braking and damping element (**11**, as well as **13**). The braking and damping element (**11**) includes again a fixed part (**2**) with a cylindrical bore hole (**3**), in which the movable part (**5**) partially inserts or dips. By the impingement of the movable part (**5**) with the mass (**9**) to be braked in the arrow direction (**10**), the movable part (**5**) inserts in the arrow direction (**8**) in the bore hole (**3**) of the fixed part (**2**). To return the movable part (**5**) in its exit position (as shown in **FIG. 2**), the

movable part is partially formed as a hollow cylinder; whereby, there is a compression spring (12) that is located between the movable part (5) and the base of the bore hole (3), which is sized accordingly, the friction force overcomes the movable part again and puts it back in the normal (starting) position. The duration, which is necessary for the pull-back position, depends, naturally, on the selected spring force and can, according to the application purpose, be selected.

[0040] FIG. 3 essentially shows the same principle as in **FIG.** 2; however, here has a tension spring (**14**) inserted as a pull-back member. The tension spring (**14**) is located between a set point and the movable part (**5**).

[0041] The braking and damping characteristics of the braking and damping element can be controlled by profiling the surface form of the parts that move to each other. To this, **FIG.** 4 shows a braking and damping element (**15**), whose surface (**16**) of the fixed parts has a certain axial profile (that is, whose cross-section adjusts itself according to the penetration depth). In exactly the same way, the movable part of the braking and damping element has a profiled surface (**17**), which works together with the profiled surface (**16**) of the fixed part in the desired manner. Now the movable part is pushed in the arrow direction into the notch of the fixed part by the force of a mass to be decelerated or braked, so, according to the position of the movable part, the width of the gap (**18**) is adjusted or modified; whereby, the braking force changes accordingly. So a freely chosen damping characteristics can be achieved, which can, for example, have a progressive, decreasing, linear or another specific funtion.

[0042] FIG. 5 shows a radial profiling of the motion of damping element (**20**); whereby, the notch or recess in the fixed part of the damping element (**20**) has, respectively, the profiling (**22**) of the shaped profiling (**21**). This radial profiling serves to enlarge the surface, that makes it possible to reduce the size of the braking and damping element (**20**).

[0043] FIG. 6 shows another design of a braking and damping element (**25**), consisting of several fixed, essentially straight-formed, thin lamellas (**26**) and, corresponding, essentially straight-formed, thin, movable lamellas (**27**); whereby, the surfaces of the mutually related lamellas (**26**, **27**) are moistened with the highly viscous medium. The operation is identical to that described above. When the lamellas (**26**, **27**) are moved against each other (for example, by force activated in arrow direction [**28**]), the braking operation is activated when it touches the inner molecular friction of the highly viscous medium.

[0044] FIG. 7 shows another embodiment of a braking and damping element (**29**), according to a shoe brake principle. It is shown in one example as having a u-shaped running surface (**30**), in which a shoe brake (**31**), that can be slid, is placed. The width of the shoe brake (**31**) is chosen so that gap remains between the shoe brake and the wall of the running surface (**30**); the gap is moistened with the highly viscous medium. If the shoe brake (**31**) (for example, in arrow direction [**33**]) moves opposite the running surface (**30**), the braking action described above takes place. Then a fixed gap dimension or, especially, also a controlled gap dimension are used, so that (for example, the shoe brake [**31**]), the shoe brake is designed in two parts and each part is pressed by a corresponding device in arrow direction (**32**) against the running surface (**30**). The more the pressure is asserted, the smaller the gap is and the more the brake is activated.

[0045] **FIG.** 8 shows a braking element (**34**) in the form of an outer brake shoe with a running surface (**35**) on which a shoe brake is placed. The running surfaces (that is, the shoe brake's inner surface) is moistened with the highly viscous medium so that a force activation in arrow direction (**37**) of the brake cycle is released.

[0046] In contrast to a linear braking movement, as previously described in the embodiment examples, **FIG.** 9 shows an embodiment of a braking element (**38**) in which a movable part (**41**) is guided, able to turn inside a fixed part (**39**). Between the inner surface (**40**) of the fixed part (**39**) and the outer surface (**42**) of the movable part (**41**), the gap (**43**) is formed in a known manner, which is essentially filled with a highly viscous medium. A mass to be decelerated or braked (**45**) impacts in arrow direction (**46**) on the movable part (**41**), which then moves around its rotation axis in arrow direction (**44**) and the mass (**45**) brakes.

[0047] **FIG.** 10 shows a catch device (**47**) for drawers, which is equipped with an invention-related braking and damping element (**48**). The catch device (**47**) has a half-open casing in which a catch lever (**49**) in arrow direction (**54**) (respectively, in the opposite direction) is guided slidable. The braking and damping element (**48**) is essentially designed according to the previously described **FIG.** 2, as well as **FIG.** 3. The movable mass (**52**) is concerned with a drawer that is equipped with a catch pin (**53**), which engages in the catch lever (**49**) when the drawer is closed. As a result, the catch lever (**49**) moves in arrow direction (**54**) with the speed of the mass (**52**); as a result of which the braking operation of the braking and damping elements (**48**) is activated and the mass (**52**) brakes. By means of spring force with a tension spring (**50**) or, respectively, a compression spring (**51**), the mass (**52**) moves actively up to the end stop. The movement's speed can be freely chosen by the design lay-out of the damper's resistance to the braking and damping element (**48**), as well as by the spring's strength.

Drawing Legend

[0048] 1. Braking and damping element

[0049] 2. Fixed part

[0050] 3. Bore hole

[0051] 4. Surface

[0052] 5. Movable part

[0053] 6. Surface

[0054] 7. Gap/distance

[0055] 8. Arrow direction

[0056] 9. Mass

[0057] 10. Arrow direction

[0058] 11. Braking and damping element

[0059] 12. Compression spring

[0060] 13. Braking and damping element

[0061] 14. Tension spring

[0062] 15. Braking and damping element

[0063] 16. Surface (fixed)

[0064] 17. Surface (movable)

[0065] 18. Gap/distance

[0066] 19. Arrow direction

[0067] 20. Braking and damping element

[0068] 21. Surface (fixed)

[0069] 22. Surface (movable)

[0070] 23. Gap/distance

[0071] 24. Arrow direction

[0072] 25. Braking and damping element

[0073] 26. Lamellas (fixed)

[0074] 27. Lamellas (movable)

[0075] 28. Arrow direction

[0076] 29. Braking and damping element

[0077] 30. Running surface

[0078] 31. Brake shoe

[0079] 32. Force

[0080] 33. Arrow direction

[0081] 34. Braking and damping element

[0082] 35. Running surface

[0083] 36. Brake shoe

[0084] 37. Arrow direction

[0085] 38. Braking and damping element

[0086] 39. Fixed part

[0087] 40. Surface

[0088] 41. Movable part

[0089] 42. Surface

[0090] 43. Gap/distance

[0091] 44. Arrow direction

[0092] 45. Mass

[0093] 46. Arrow direction

[0094] 47. Catch device

[0095] 48. Braking and damping element

[0096] 49. Catch lever

[0097] 50. Tension spring

[0098] 51. Compression spring

[0099] 52. Mass

[0100] 53. Pin

[0101] 54. Arrow direction

[0102] 55. Arrow direction

1. Process to control braking of a moved mass by means of a braking and damping element is characterized by one or more surfaces (4, 6), moistened with a highly viscous liquid-containing medium, the braking and damping element (1) that always have a fixed part and a movable part (2, 5), which after the mass (9) impacts with the movable part (5), are moved against each other for a certain distance, so that the liquid-containing medium by its retention on the surfaces (4, 6) puts out an inner molecular friction; whereby, the kinetic energy of the mass (9) to be intercepted is transferred in frictional heat.

2. Process, according to claim 1, is characterized by a medium, whose coefficient of friction depends on the speed at which the parts (2, 5) move to each other.

3. Process, according to claims 1 or 2, is characterized by the fact that after the braking or deceleration of the mass (9), only a small force (e.g. a spring action) is needed in order to move the mass (9) up to a provided end stop.

4. Process, according to claims 1 through 3, is characterized by the damping process that can be modified by changing the distance and/or changing the surface form of the surfaces (4, 6).

5. The braking and damping element to control the deceleration or braking of the moved mass is characterized by at least one fixed and one movable part (2, 5); whereby, the movable part (5) is subjected to the mass (9), which can be decelerated, and in relation to the fixed part (2), is movable opposite the fixed part (2) for a defined distance; whereby, the parts (2, 5) have one or more receptive surfaces (4, 6) related to one another, and these surfaces (4, 6) are moistened with a highly viscous liquid-containing medium.

6. The braking and damping element, according to claim 5, is characterized by the medium's coefficient of friction, depending on the speed of the parts (2, 5) that are movable in relation to each other.

7. The braking and damping element, according to claims 5 or 6, is characterized by the parts (2; 5), one of which has a recess or notch (3) in any cross-section in which the other part (5; 2) essentially has the same cross-section; whereby, a gap (7) is located between the surface (4) of the notch (3) or recess and the surface (6) of the part (5; 2) that has been taken up, in which the medium is located.

8. The braking and damping element, according to claim 7, is characterized by the largest diameter of one part (5; 2) is less than about the double the gap's (7) width, so it can be inserted into the smallest diameter of the notch/recess (3).

9. The braking and damping element, according to claims 5 to 8, is characterized by the notch/recess (3) and/or the surface (6) in which the notch's (3) guided part (5; 2) are axially and/or radially profiled.

10. The braking and damping element, according to claims 5 or 6, is characterized by several lamellas (26, 27) that move against each other.

11. The braking and damping element, according to claims 5 or 6, is characterized by the disk or shoe brake (29) that is designed as an inside disk or shoe brake or an external disk or shoe brake.

12. The braking and damping element, according to claims 10 or 11, is characterized by the lamellas' (26, 27) surfaces and or disk or shoe brakes (31) and/or respectively opposite surfaces (30).

13. The braking and damping element, according to claims 5 or 6, is characterized by the movable part (39) that is designed as a revolving rotation part (41) in the fixed part.

14. The braking and damping element, according to one of the claims 5 to 13, is characterized by the movable part (5) that includes an operating pull-back member (12; 14).

15. The braking and damping element, according to claim 14 is characterized by the pull-back member (**12**; **14**) that is designed as a spring element.

16. The braking and damping element, according to one of the claim 5 to **15**, is characterized by a readjusting free running that is provided for the forced lifting or release of the brake operation.

17. The braking and damping element, according to one of the claims 5 to 16, is characterized by a buffer, made from an elastic and/or springy material that is located between the mass (**9**), which is be braked or decelerated, and the movable part (**5**) of the braking and damping element.

* * * * *